

What is claimed is:

1 1. An apparatus comprising:

2 a plurality of processing units;

3 a monitor to obtain a plurality of monitor values from said plurality of

4 processing units, wherein said monitor is to transfer a process from a first

5 processing unit of said plurality of processing units to a second processing

6 unit of said plurality of processing units in response to said plurality of

7 monitor values.

1 2. The apparatus of claim 1 wherein said monitor is to transfer the process from the first

2 processing unit to the second processing unit in response to a first one of said

3 plurality of monitor values being greater than a second one of said plurality of

4 monitor values over a period of time.

1 3. The apparatus of claim 2 wherein said monitor obtains a monitor value by at least one

2 of the set consisting of:

3 receiving a temperature indicator;

4 estimating an activity level;

5 receiving a power consumption estimate.

1 4. The apparatus of claim 1 wherein each of said plurality of processing units is one of a

2 set consisting of:

- 3 a core of a multi-core processor;
4 an execution unit of a processor;
5 a separate processor unit.

1 5. The apparatus of claim 1 wherein said monitor is further to increase and decrease a
2 voltage level depending on a total power consumption or temperature level of said
3 plurality of processing units.

1 6. The apparatus of claim 1 wherein said monitor comprises:
2 an exchange module to exchange processes between ones of said plurality of
3 processing units.

1 7. The apparatus of claim 1 wherein said monitor comprises:
2 a move module to move one process from one of said plurality of processing units
3 to another one of said plurality of processing units that is idle.

1 8. The apparatus of claim 6 wherein said monitor further comprises:
2 a move module to move one process from one of said plurality of processing units
3 to another one of said plurality of processing units that is idle;
4 a sum module to throttle processing of one or more of said plurality of processing
5 units if a sum total of power consumption of said plurality of processing units
6 exceeds a selected total power consumption metric;
7 a shutdown module to shut down one or more of said plurality of processing units

8 in a low power mode.

1 9. The apparatus of claim 1 further comprising:

2 a cache coupled to said plurality of processing units, wherein said monitor is to
3 swap processes between said first processing unit and said second processing
4 unit by saving a first plurality of state variables from said first processing unit
5 in said cache and saving a second plurality of state variables from said second
6 processing unit in said cache and restoring said second plurality of state
7 variables to said first processing unit from said cache and restoring said first
8 plurality of state variables to said second processing unit from said cache.

1 10. The apparatus of claim 9 wherein said cache, said first processing unit, and said
2 second processing unit are integrated on a single integrated circuit die, and wherein
3 said cache is physically positioned between said first processing unit and said second
4 processing unit.

1 11. The apparatus of claim 1 wherein said first processing unit and said second
2 processing unit are coupled to receive power from different power wells and are
3 capable of being independently operated at different voltages and frequencies under
4 control of the monitor.

1 12. A multi-core processor comprising:

2 a first core having first instruction fetch and execute logic and a plurality of first

4 a temperature level.

1 16. A system comprising:

2 a plurality of processing units, each processing unit to track its power
3 consumption, and to support a process move procedure;
4 a monitor to receive monitor information from each of said plurality of processing
5 units and to re-allocate processes to different ones of said plurality of
6 processing units in response to the monitor information received from the
7 plurality of processing units;
8 a memory coupled to said plurality of processing units to store instructions for
9 execution by said plurality of processing units.

1 17. The system of claim 16 wherein said monitor comprises:

2 a power-aware scheduler to schedule tasks for specific ones of said plurality of
3 processing units in response to said monitor information received from said
4 plurality of processing units.

1 18. The system of claim 17 wherein said power-aware scheduler is chosen from the set

2 consisting of:

3 an operating system scheduler that is stored in said memory during operation;
4 a hardware scheduler.

1 19. The system of claim 16 wherein said monitor comprises:

2 an exchange module to exchange processes between ones of said plurality of

3 processing units;

4 a move module to move one process from one of said plurality of processing units

5 to another one of said plurality of processing units that is idle;

6 a sum module to throttle processing of one or more of said plurality of processing

7 units if a sum total of power consumption of said plurality of processing units

8 exceeds a selected total power consumption metric;

9 a shutdown module to shut down one or more of said plurality of processing units

10 in a low power mode.

1 20. A method comprising:

2 monitoring power consumption of a plurality of processing units;

3 swapping processes between said plurality of processing units in response to

4 monitoring power consumption of said plurality of processing units.

1 21. The method of claim 20 wherein swapping comprises:

2 exchanging processor state data via a cache memory.

1 22. The method of claim 20 further comprising:

2 moving a process from a first one of said plurality of processing units to an idle

3 one of said plurality of processing units in response to monitoring power

4 consumption of said plurality of processing units.

1 23. The method of claim 21 further comprising:

2 reducing power consumption of one or more of said plurality of processing units

3 in response to a sum of power consumed exceeding a selected total power

4 consumption metric;

5 increasing power consumption of said plurality of processing units in response to

6 the sum of power consumed being less than a second selected total power

7 consumption metric.

1 24. The method of claim 23 further comprising:

2 periodically rearranging processes among said plurality of processing units.

1 25. The method of claim 20 further comprising:

2 independently controlling voltages and frequencies for said plurality of processing

3 units in response to monitoring power consumption of the plurality of

4 processing units.

1 26. An apparatus comprising:

2 a plurality of processing units;

3 a module to periodically transfer processes from a first processing unit from

4 said plurality of processing units to a second processing unit from said

5 plurality of processing units.

1 27. The apparatus of claim 26 further comprising a thermal monitor to independently
2 control voltage levels of said plurality of processing units in response to a plurality of
3 temperature levels of said plurality of processing units.

1 28. The apparatus of claim 27 wherein said thermal monitor is also to independently
2 control clock frequencies for said plurality of processing units in response to said
3 plurality of temperature levels.

1 29. An article comprising a machine readable medium storing a plurality of instructions
2 which, if executed by a machine, cause the machine to perform operations
3 comprising:
4 monitoring power consumption and/or thermal levels of a plurality of processing
5 units;
6 swapping processes between said plurality of processing units in response to
7 monitoring power consumption of said plurality of processing units.

1 30. The article of claim 29 wherein swapping comprises:
2 exchanging processor state data via a cache memory.

1 31. The article of claim 29 wherein said operations further comprise:
2 moving a process from a first one of said plurality of processing units to an idle
3 one of said plurality of processing units in response to monitoring the power
4 consumption of said plurality of processing units.

1 32. The article of claim 30 wherein said operations further comprise:
 2 reducing power consumption of one or more of said plurality of processing units
 3 in response to a sum of power consumed exceeding a selected total power
 4 consumption metric;
 5 increasing power consumption of said plurality of processing units in response to
 6 the sum of power consumed being less than a second selected total power
 7 consumption metric.

1 33. The article of claim 32 wherein said operations further comprise:
 2 periodically rearranging processes among said plurality of processing units.

1 34. The article of claim 29 wherein said operations further comprise:
 2 independently controlling voltages and frequencies for said plurality of processing
 3 units.

1 35. A method comprising:
 2 monitoring temperature levels of a plurality of processing units;
 3 swapping processes between said plurality of processing units in response to
 4 monitoring temperature levels of said plurality of processing units.

1 36. The method of claim 35 wherein swapping comprises:
 2 exchanging processor state data via a cache memory.

